A Conjecture on the Nature of Digital Information

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Introduction

The term conjecture is can be used to mean an unproven proposition that appears to be correct. Conjectures can be useful in encouraging consideration of problems and in pointing towards possible solutions or ways of understanding.

In this paper I will suggest a conjecture on the nature of digital information. My hope is that it advances the how we think about this topic. It is my view that the conjecture is generally correct and that it should lead us to think about and develop information products differently than we have done when information was based on printing. The medium matters and matters in ways that are not always expected or appreciated. As Clay Shirky puts it, "When we change the way we communicate, we change society."[1]

The Conjecture:

1. ***When information is digital it is non-rival and can be reproduced and distributed at close to zero marginal cost.***
2. ***When information is non-rival and can be reproduced and distributed at close to zero marginal cost people will want it to be open.***
3. ***When information is open it encourages social production.***

The Argument

Proposition 1. When information is digital it is non-rival and can be reproduced and distributed at zero marginal cost.

One of the ways economists think about goods is to categorize them as either rival or non-rival. A rival good can only be used by a single person at any given time. In contrast, a non-rival good may be used or consumed by one person without preventing the simultaneous use or consumption by others.[2] Tangible

[1] Clay Shirky, Here Comes Everybody: The Power of Organizing without Organizations, New York, NY: Penguin Press, 2008, page 17.
[2] See: "Rivalry (economics)," *Wikipedia*. Available at: http://en.wikipedia.org/wiki/Rivalry_(economics)

goods, that is goods made of atoms, are rival goods as are many services that take place in the real world such as a visit to the doctors or a trip on an airplane. Some goods like the use of a park or road are non-rival, but only up to the point of the capacity of the good. Information in all its forms and formats is a non-rival good. As Thomas Jefferson famously said, "He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening me."[3] But in the past while the information itself was a non-rival good the means of reproducing and distributing that information, printed items such as books and newspapers, were not. This constrained the flow on information so that like the use of a park or a road it was in practice only non-rival up to the capacity of the information channel. In the digital world this constraint on the non-rival nature of information is removed.

This is true because of the second characteristic of digital information. It can be reproduced and distributed at close to zero marginal cost. We need to be very clear that this does not mean that information is free. Information is often very expensive to produce, but the expense is in the first copy. In the digital world, as Carl Shapiro and Hal Varian put it, "Information is costly to produce but cheap to reproduce."[4]

The combination of being non-rival and being able to be reproduced and distributed at close to zero marginal cost means that digital information is significantly different from what came before. The differences encourage different desires and behaviors.

Proposition 2: When information is non-rival and can be reproduced and distributed at close to zero marginal cost people will want it to be open.

This is where the conjecture begins to become speculative. But speculative doesn't necessarily mean wrong.

Open can be tricky to define, but let's start with Peter Suber's definition of open access. As he defines it, "Open access (OA) literature is digital, online, free of charge, and free of most copyright and licensing restrictions."[5] Many people

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[3] Letter from Thomas Jefferson to Isaac McPherson 13 Aug. 1813, *Writings 13:333—35.* As quoted in *The Founders' Constitution*, edited by Philip B. Kurland and Ralph Lerner, Web Edition, University of Chicago Press and the Liberty Fund. Available at: http://press-pubs.uchicago.edu/founders/documents/a1_8_8s12.html

[4] Carl Shapiro and Hal R. Varian, *Information Rules: A Strategic Guide to the Network Economy*, Boston, MA: Harvard Business School Press, 1998, page 21.

[5] Peter Suber, *Open Access*, Cambridge: The MIT Press, 2012, page 4. Also available at: http://cyber.law.harvard.edu/hoap/Open_Access_(the_book)#About_the_book

think of open access as a movement, but it is really a business model. In the open access business model the first copy and infrastructure costs are covered in some way that does not involved charging readers or their libraries. There are a variety of ways these costs can be covered from charging authors to philanthropy or institutional subsidies. Once the content is created it is distributed over the network and given away freely to readers. Because of the declining cost of computing and bandwidth, the infrastructure can be inexpensive, sometimes free, and the first copy costs can also be reduced for similar reasons. Importantly, open access is cheaper because it does away with most of the costs associated with having paying customers such as marketing, sales, billing, and the costs of restricting access to only to those who have paid such as paywalls and lawyers.

I have argued that open access in inevitable, but the case I was making was that the business model of open access was a disruptive innovation, as defined by the business theorist Clayton Christensen, and, because of the cost advantages cited above, that it will inevitably come to supplant the subscription business model for the scholarly journal literature.[6] The argument here is different.

When information is non-rival and can be reproduced and distributed at close to zero marginal cost people will want it to be open because they will want to share it. People want to share because that is what people do. We are social beings and sharing is central to how we live our lives. People share goods even when the result is that they are giving up something they would otherwise have had for themselves. Even when there is a cost to the act of sharing people do it all of the time. But when sharing has close to no cost and when I can keep what I share with you, then sharing will be the default behavior.

Owners of information try to constrain information sharing in order to maintain their ability to sell it, and the under copyright law they have the power to do so in many situations as copyright creates a monopoly for the owner. Owners who wish to extract monetary value from their ownership of information charge for its use and assert their copyrights through licensing agreements. But in doing so they are working against human nature. They may be successful when they are not overly greedy, but even the law abiding person will share in some circumstance, even when this sharing violates the letter of the law. We all want to be generous when we can and the perceived harm done is minimal.

We also need to be clear that just because we will want digital information to be open that won't necessarily make it so. We can expect that much information will

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[6] David W. Lewis, "The Inevitability of Open Access," *College & Research Libraries* 73(5):493-506 September 2012. Available at: http://crl.acrl.org/content/73/5/493.full.pdf+html and http://hdl.handle.net/1805/2929

be closed and tolls will be charged for access as owners extract monopoly rents. We can though expect that over time generosity will slowly win out and increasingly large portions of digital information will become open. Creators, especially those whose largest return from their creations are in status and prestige, will choose openness because sharing and generosity are not only good things to do, but also because openness serves their personal and professional interests.

Proposition 3: When information is open it encourages social production.

Social production, or as it is sometimes call commons-based peer production has been championed by among others Yochai Benkler who has said of it:

> Social production is a real fact, not a fad. It is the critical long-term shift caused by the Internet. Social relations and exchange become significantly more important than they ever were as an economic phenomenon. In some contexts, it's even more efficient because of the quality of the information, the ability to find the best person, the lower transaction costs. It's sustainable and growing fast.[7]

Benkler discusses social production at length in his book *The Wealth of Networks*.[8] Social production is, as *Wikipedia*, itself maybe the most successful and well know product of social production, puts it, "a new model of socio-economic production in which the creative energy of large numbers of people is coordinated (usually with the aid of the Internet) into large, meaningful projects mostly without traditional hierarchical organization. These projects are often, but not always, conceived without financial compensation for contributors."[9] Social production works when the project can be chunked into small pieces and/or modularized so that many people can make small contributions, and when the coordinating mechanisms can be built into the project infrastructure. Dan Bricklin identifies several of the attributes that contribute to the success of social production in his classic blog post, "The Cornucopia of the Commons: How to

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[7] Yochai Benkler, "The New Open-Source Economics," TEDGlobal 2005, July 2005. Available at: http://www.ted.com/talks/yochai_benkler_on_the_new_open_source_economics.html

[8] Yochai Benkler, *The Wealth of Nations: How Social Production Transforms Market and Freedom*, New Haven, CT: Yale University Press, 2006. Also available at: http://cyber.law.harvard.edu/wealth_of_networks/Main_Page

[9] "Commons-based peer production," *Wikipedia*. Available at: http://en.wikipedia.org/wiki/Social_production

Get Volunteer Labor."[10] He suggests that when contributions that we make for ourselves add to the common resource they are more likely to be successful. The product gets better through use and no altruistic motive is required. Bricklin also suggests that the best systems are guilt free. As he says, "Instead of making you feel bad for 'only' doing 99%, a well designed system makes you feel good for doing 1%. People complain about systems that have lots of 'freeloaders'. Systems that do well with lots of 'freeloading' and make the best of periodic participation are good."[11]

My favorite example of social production involves a very hard scientific problem. For a decade biochemists had unsuccessfully attempted to decipher the structure of retroviral protease an enzyme that is key to the way HIV multiplies. Determining structure or folding of a protein is a difficult task, as the fact that this important problem remained unsolved for ten years demonstrates. To help solve protein folding problems in 2008 a team at the University of Washington developed Foldit a game that enlisted players to help solve protein folding problems.[12] When retroviral protease was introduced into the game, it was solved in ten days.[13] When the scientific article reporting the finding appeared in *Nature Structural & Molecular Biology*, two of the authors were the gamer teams the Foldit Contenders Group and the Foldit Void Crushers Group who had solved the problem.[14] When the *The Onion* got the news they commented, "It wouldn't kill those scientists to spring for a couple cases of Mountain Dew for this."[15]

Benkler sees social production as a fourth means of getting things done. The first three, markets, firms, and bureaucracies have been around for a long time

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[10] Dan Bricklin, "The Cornucopia of the Commons: How to Get Volunteer Labor," August 7, 2000, with additional comments April 23, 2001 and October 12, 2006. Available at: http://www.bricklin.com/cornucopia.htm

[11] Dan Bricklin, "The Cornucopia of the Commons: How to Get Volunteer Labor," August 7, 2000, with additional comments April 23, 2001 and October 12, 2006. Available at: http://www.bricklin.com/cornucopia.htm

[12] See the Foldit website at: http://fold.it/portal/

[13] See: Wouter Stomp, "Foldit Success Story: Monkey Virus Retroviral Protease Structure Solved Within Days," MedGadget, September 19, 2011. Available at: http://www.medgadget.com/2011/09/foldit-success-story-monkey-virus-retroviral-protease-structure-solved-within-days.html or Elizabeth Armstrong Moore, "Foldit Games Leads to AIDS Research Breakthrough," CNET, September 19, 2011. Available at: http://www.cnet.com/news/foldit-game-leads-to-aids-research-breakthrough/

[14] Firas Khatib, et.al., "Crystal Structure of a Monomeric Retroviral Protease Solved by Protein Folding Game Players," *Nature Structural & Molecular Biology* 18:1175-1177 September 18, 2011 doi:10.1038/nsmb.2119. Available at: http://www.nature.com/nsmb/journal/v18/n10/full/nsmb.2119.html

[15] "Gamers Succeed Where Scientists Couldn't," The Onion, September 26, 2011. Available at: http://www.theonion.com/articles/gamers-succeed-where-scientists-couldnt,26175/

and are well understood. Social production is not entirely new, think of barn raisings or quilting bees, but with network connectivity it is a method that can be used to tackle a wide range of more substantial projects.

The motivation for contributing time and energy to social production projects is not clear from within the confines of traditional economic theory that posits self-interest as the primary driver of human behavior. Through this lens giving away time and energy without an economic return makes no sense. This view is of course limited and incomplete. People do things for each other all of the time with no expectation of monetary compensation. We do this to build and reinforce social bonds and because as people we enjoy creating and sharing. What has changed is that the digital environment allows the scale of social production to grow from families and local communities, where it has largely been in the past, to a global enterprises, like *Wikipedia*, that are now possible. As Clay Shirky nicely puts it, "We are use to living in a world where little things happen for love and big things happen for money. Love motivates people to bake a cake and money motivates people to make an encyclopedia. Now, though, we can do big things for love."[16]

When information is open sharing is easy and so is commenting, enhancing and remixing. When commenting, enhancing and remixing are easy people will do it because this is what people do. When people have made their comments, enhancements and remixes, they will share them and if everything is open because they can do so easily. If a little coordination is applied a project is born. If the coordination is built into the system then the project can go to world scale and we end up with Unix or Apache or *Wikipedia* or any one of thousands of other small and large projects. All of this begins when information becomes digital and continues if the digital information is open and concludes with remarkable cooperative collaborative accomplishments.

[16] Clay Shirky, *Here Comes Everybody: The Power of Organizing without Organizations*, New York: Penguin Press, 2008. Page 104.